FERN FLIES OF AUSTRALIA: THE GENUS *TERATOMYZA S.L.* (DIPTERA: TERATOMYZIDAE)

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Abstract

The broad concept of the genus *Teratomyza* Malloch (*sensu* McAlpine and de Keyzer 1994) is retained so that *Vitila* McAlpine & de Keyzer, syn. n. and *Poecilovitila* Papp, syn. n. are no longer utilised at either generic or subgeneric level. *Teratomyza* is here provisionally divided into seven informal species groups. *Teratomyza smithersi* sp. n. and *T. pappi* sp. n. (both from Queensland) are described. The following new generic combinations are made for species originally described in *Poecilovitila* Papp: *Teratomyza barbata* (Papp, 2011), comb. n.; *Teratomyza brevicornis* (Papp, 2011), comb. n.; *Teratomyza bulbiscapus* (Papp, 2011), comb. n.; *Teratomyza defecta* (Papp, 2011), comb. n.; *Teratomyza elegans* (Papp, 2011), comb. n.; *Teratomyza erugata* (Papp, 2011), comb. n.; *Teratomyza hindustanica* (Papp, 2011), comb. n.; *Teratomyza japonica* (Papp, 2011), comb. n.; *Teratomyza taiwanica* (Papp, 2011), comb. n.; *Teratomyza thaii* (Papp, 2011), comb. n.; *Teratomyza variegata* (Papp, 2011), comb. n.

Introduction

The Teratomyzidae or fern flies have a mainly south-temperate distribution (South America, Australia, New Zealand), but one of the seven here recognised genera (*Teratomyza* Malloch *s.l.*) has a wider distribution, extending from New Zealand to eastern Asia via Australia and New Guinea. As the Asian species of the family share a set of apomorphic character states with certain of the temperate Australasian taxa, I consider that all these should be included in the apparently monophyletic, though polytypic, genus *Teratomyza*, as delimited by McAlpine and de Keyzer (1994).

This paper makes known two undescribed species of *Teratomyza* of Queensland. Some additional undescribed species of New Guinea and the Oriental Region are mentioned below under *Teratomyza* groups 2-6.

The following abbreviations are used for institutions holding collections: AM, Australian Museum, Sydney; ANIC, Australian National Insect Collection, CSIRO, Canberra; BPB, B.P. Bishop Museum, Honolulu; CNC, Canadian National Collection, Agriculture Canada, Ottawa; HELS, Zoological Museum, University of Helsinki, Helsinki; QM, Queensland Museum, Brisbane.

Notes on morphology

The nomenclature of the bristles (enlarged and individually differentiated macrotrichia) on the upper back of the head in schizophoran flies has been confused in the literature. I have attempted (McAlpine 2007) more accurately to systematise the identification and terminology of these bristles, and this system is here relevant because of taxonomic variation in the bristle pattern in *Teratomyza s.l.* The postvertical bristles are reduced in the Teratomyzidae and are often scarcely differentiated from the nearby setulae (small macrotrichia of irregular placement). In *Teratomyza* group 1 (including *T.*

neozelandica Malloch and perhaps one or two closely similar species), the series of postocular setulae terminates dorsomedially below the level of the outer vertical bristle. Widely separated from that series and located behind and slightly mesad of the inner vertical bristle (Fig. 2), is the bristle I identify as the paravertical bristle, as it corresponds in position to that bristle in other families (*e.g.* Heteromyzidae and Pseudopomyzidae). In other species groups (*e.g.* group 7, Fig. 3), there is no such isolated paravertical bristle and the series of postocular setulae often extends further mesad.

In some teratomyzid taxa (numerous examples figured by McAlpine and de Keyzer 1994 and Papp 2011), some of the macrotrichia on the surstylus of the male are short, very stout, and peg-like or tooth-like (see Figs 5, 6, 8). I refer to these as blunt spinules, to distinguish them from the slender, fine-tipped setulae, often also present on the surstylus.

Genus *Teratomyza* Malloch

Teratomyza Malloch, 1933: 113-114. Type species *T. neozelandica* Malloch (original designation).

Vitila McAlpine & de Keyzer, 1994: 321 (as subgenus of *Teratomyza*). Type species *T. (Vitila) undulata* McAlpine & de Keyzer (original designation). Syn. n.

Poecilovitila Papp, 2011: 11. Type species *P. elegans* Papp (original designation). Syn. n.

Diagnostic description. Head. Postfrons not setulose anteriorly; cheek region commonly with upper and lower series of setulae; palpus absent or very minute. Thorax. Dorsocentral bristles two pairs; mesopleural (anepisternal) and pteropleural (anepimeral) bristles absent; costa distally with variably reduced setiferous tubercles; anal cell (cup) not strongly enclosed on posterior side; alular lobe and alular incision absent; fringe of alular setulae reduced or absent. Male postabdomen. Aedeagus prominent, somewhat elongate, asymmetrical. Female abdomen. Tergite 7 and sternite 7 broadly fused, annular.

Notes. The genus *Teratomyza sensu* McAlpine and de Keyzer (1994) has been divided into three genera by Papp (2011), *viz. Teratomyza* (*s.str.*), *Vitila* and *Poecilovitila*. My own studies indicate that these categories are less well defined than indicated by Papp and that his restricted genus *Teratomyza*, still including both Asian and New Zealand species and defined only by plesiomorphic character states, is very probably paraphyletic. I find significant morphological differences between the available Asian and New Zealand taxa (the latter including the type species), but both categories lack the obvious apomorphic wing features that characterise his so-called genera *Vitila* and *Poecilovitila*. Several taxa not considered by Papp possess character combinations which tend to link his major groupings, but some are still very incompletely known. I consider that the apparently monophyletic genus *Teratomyza s.l.* (*e.g.* Fig. 1) is best divided into seven informal species

groups on the basis of present knowledge, and that such formal categories as subgenera should be avoided.

Fig. 1. *Teratomyza smithersi* sp. n., male from Upper Tully River.

Key to species groups of *Teratomyza s.l.*

1 Paravertical bristle usually present behind and slightly mesad of inner vertical bristle and widely separated from largest postocular setula, latter located behind but not mesad of outer vertical bristle (Fig. 2); male: surstylus arising well within border of epandrium; cercus vestigial or apparently absent; New Zealand ..... group 1

- Paravertical bristle absent; largest postocular setula located at least slightly laterad of inner vertical bristle and not widely separated from rest of postocular series (Fig. 3); male (where known): surstylus articulated with lateral margin of epandrium; cercus well developed, setulose; not in New Zealand 2

2 Postfrons with longitudinal stripes; wing membrane with four or five white spots between costa and vein 2; sternopleural bristles two, large; eastern Australia ..... group 7

- Postfrons without longitudinal stripes; wing without series of white spots between costa and vein 2; only one sternopleural bristle well developed; not in Australia 3

3 Vein 2 near its mid-length closely approximated to costa, but usually diverging from costa again before distal termination 4

- Vein 2 not closely approximated to costa and then diverging before distal termination 6

4 Anterior crossvein (r-m) at least twice as long as discal crossvein (dm-cu); basal section of vein 4 strongly arched, making second basal cell much broader than first basal cell in this region; New Guinea ..... group 6

- Anterior crossvein not much longer than discal crossvein; basal section of vein 4 not arched, thus second basal cell not broader than first basal cell; Oriental and eastern Palaearctic Regions 5

5 Wing membrane with some brownish shading and usually a hyaline spot in submarginal cell beyond end of vein 2; vein 5 with complex curvature (sometimes slight) immediately beyond discal crossvein (Papp 2011: figs 112-121); transverse ridge of vertex strongly elevated laterally so that, in exact profile, outer vertical bristle arises much above upper margin of eye ..... group 5

- Wing membrane quite clear; vein 5 without such complex curvature; transverse ridge of vertex relatively little elevated laterally, outer vertical bristle arising little above upper margin of eye ..... group 4

6 Ocellar bristle small, not over half as long as fronto-orbital bristle; eye markedly longer than high; vein 2 rather strongly curved; thoracic pleura with dark brown longitudinal stripe; New Guinea ..... group 3

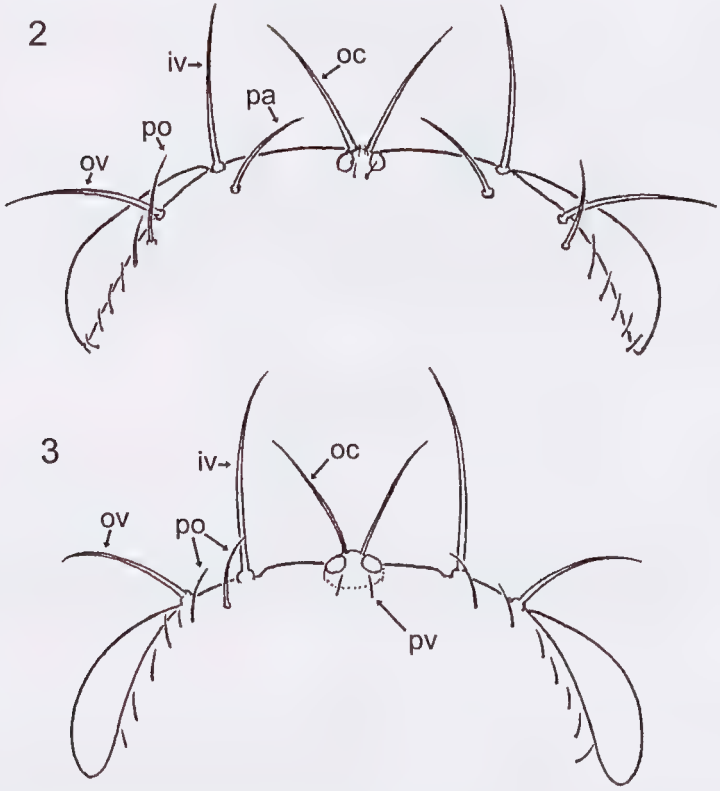
- Probably not agreeing in above characters (only limited material and limited published information available); Oriental and eastern Palaearctic Regions ..... group 2

Teratomyza group 1

Included species: Teratomyza neozelandica Malloch; possibly one or more closely related undescribed species.

Distribution: New Zealand (North and South Islands).

Notes. This group is not adequately studied, but my observations suggest that it can be distinguished from other groups by the characters given in the key. Of the 29 specimens examined, only one lacks the paraverticals shown in Fig. 2. The surstylus lacks blunt spinules.



Figs 2-3. Vertex of head, posterior view of: (2) *Teratomyza* nr *neozelandica* (group 1); (3) *Teratomyza smithersi* sp. n. (group 7). iv = inner vertical bristle, oc = ocellar bristle, ov = outer vertical bristle, pa = paravertical bristle, po = postocular setulae, pv = postvertical bristle.

Teratomyza group 2

Included species: Teratomyza chinica Yang Chikun; *T. formosana* Papp; *T.* sp. undescr. (Nepal, CNC).

Distribution: Oriental Region—Vietnam, Taiwan, China, Nepal.

Notes. Representatives of this group have principally been made known by Papp (2011), who described and figured the male postabdominal structure for

two species. The one species available to me (Nepal, CNC) has the mesoscutum anteriorly simply convex, no dark pleural stripe on the thorax, the postfrons very densely pruinescent, all in contrast to the condition in group 3. This species has few large terminal blunt spinules on the slender surstylus, in contrast to the two species treated by Papp.

Teratomyza group 3

Included species: *Teratomyza* sp. undescr. (Myola, Oro Province, AM).

Distribution: New Guinea (only yet known from Owen Stanley Range, Oro Province, Papua New Guinea).

Notes. The specimens (two females) show the distinctive characters given in the key to groups, but, until males become known, an adequate review of relationships is not possible. The two female specimens, collected at the same locality by J.W. Ismay, show slight differences in wing venation and chaetotaxy, and there is a slight possibility that they are not conspecific. In any case, the species cannot be accurately characterised without knowledge of the male postabdomen.

Teratomyza group 4

Included species: *Teratomyza* sp. undescr. (Nepal, CNC).

Distribution: Oriental Region—Nepal.

Notes. The group is known to me from one male specimen. It resembles some species of group 5 ('*Poecilovitila*') in having vein 2 on a substantial part of its length thickened and closely approximated to the costa. Otherwise it is without the apomorphic wing conditions of that group and superficially resembles examples of groups 1 and 2.

Teratomyza group 5

Included species: *Teratomyza barbata* (Papp, 2011) comb. n.; *Teratomyza brevicornis* (Papp, 2011) comb. n.; *Teratomyza bulbiscapus* (Papp, 2011) comb. n.; *Teratomyza defecta* (Papp, 2011) comb. n.; *Teratomyza elegans* (Papp, 2011) comb. n.; *Teratomyza erugata* (Papp, 2011) comb. n.; *Teratomyza hindustanica* (Papp, 2011) comb. n.; *Teratomyza japonica* (Papp, 2011) comb. n.; *Teratomyza taiwanica* (Papp, 2011) comb. n.; *Teratomyza thaii* (Papp, 2011) comb. n.; *Teratomyza variegata* (Papp, 2011) comb. n.; *Teratomyza* sp. undescr. (NE Burma, HELS); *Teratomyza* sp. undescr. (Fukien Province, S. China, BPB); *Teratomyza* sp. undescr. (Luzon, Philippines, BPB); *Teratomyza* sp. undescr. (Sabah (North Borneo), Malaysia, CNC). A few other specimens could represent additional Oriental species.

Distribution: Oriental Region and adjacent parts of Palaearctic Region—Japan, China, Taiwan, Nepal, India, Philippines, Vietnam, Burma, Thailand, Malaysia.

Notes. Group 5 is apparently the largest group in the genus, with at least 15 species, but none is known from east of Wallace's Line. It appears from Papp's study that all species probably have a well developed series of blunt spinules on the distal margin of the surstylus, a feature that is shared with group 7.

This group includes the type species of *Poecilovitila* Papp.

Teratomyza group 6

Included species: *Teratomyza* sp. undescr. (Papua New Guinea: mainland).

Distribution: New Guinea.

Notes. The one included species resembles those of groups 4, 5, and 7 in having vein 2 undulate, thickened, and closely approximated to the costa well before its distal end, but differs from these in its own specialised wing features as indicated in the key. A much reduced series of blunt spinules is present on the surstylus. None of these three other groups is known from New Guinea, but the smaller flies of that island are still very incompletely known.

Teratomyza group 7

Included species: *Teratomyza undulata* McAlpine & de Keyzer; *Teratomyza smithersi* sp. n.; *Teratomyza pappi* sp. n.

Distribution: eastern Australia, including Tasmania.

Notes. Group 7 is easily distinguished by the presence of two or three undulations in vein 2, presence of many white spots on the wing membrane including four or five between the costa and vein 2, and the presence of two large sternopleural bristles.

This group includes the type species of subgenus *Vitila* McAlpine & de Keyzer, *Teratomyza undulata* McAlpine & de Keyzer.

Key to species of *Teratomyza* group 7

1 Anterior and discal crossveins separated by not more than length of discal crossvein, or these two crossveins contiguous; first posterior cell (behind distal section of vein 3) with more than eight white spots; area behind vein 6 with two white spots; male: surstylus as in Fig. 6 .... *undulata* McAlpine & de Keyzer

- Anterior and discal crossveins separated by at least twice length of discal crossvein; first posterior cell with fewer than eight white spots; only one white spot behind vein 6; male: surstylus differently shaped 2

2 Vein 2 usually with three marked undulations (Fig. 4); usually five large white spots present between costa and vein 2; submarginal cell (behind distal section of vein 2) usually with seven to nine white spots; male: surstylus narrowed beyond base, so that spinulose distal margin is not

more than half as long as basal margin (Fig. 5); cercus more than half as long as surstylus ..... *smithersi* sp. n.

- Vein 2 with two marked undulations and sometimes an indistinct one distally (Fig. 7); usually four white spots present between costa and vein 2, or sometimes a smaller additional spot distally; submarginal cell usually with six white spots; male: surstylus somewhat narrowed towards mid-length, but expanded again distally, so that spinulose distal margin is as long as basal margin (Fig. 8); cercus not more than half as long as surstylus ..... *pappi* sp. n.

Teratomyza undulata McAlpine & de Keyzer

(Fig. 6)

Teratomyza (Vitila) undulata McAlpine & de Keyzer, 1994: 321-324, figs 36-43.
Vitila undulata (McAlpine & de Keyzer),—Papp 2011: 10.

Description. See McAlpine and de Keyzer (1994).

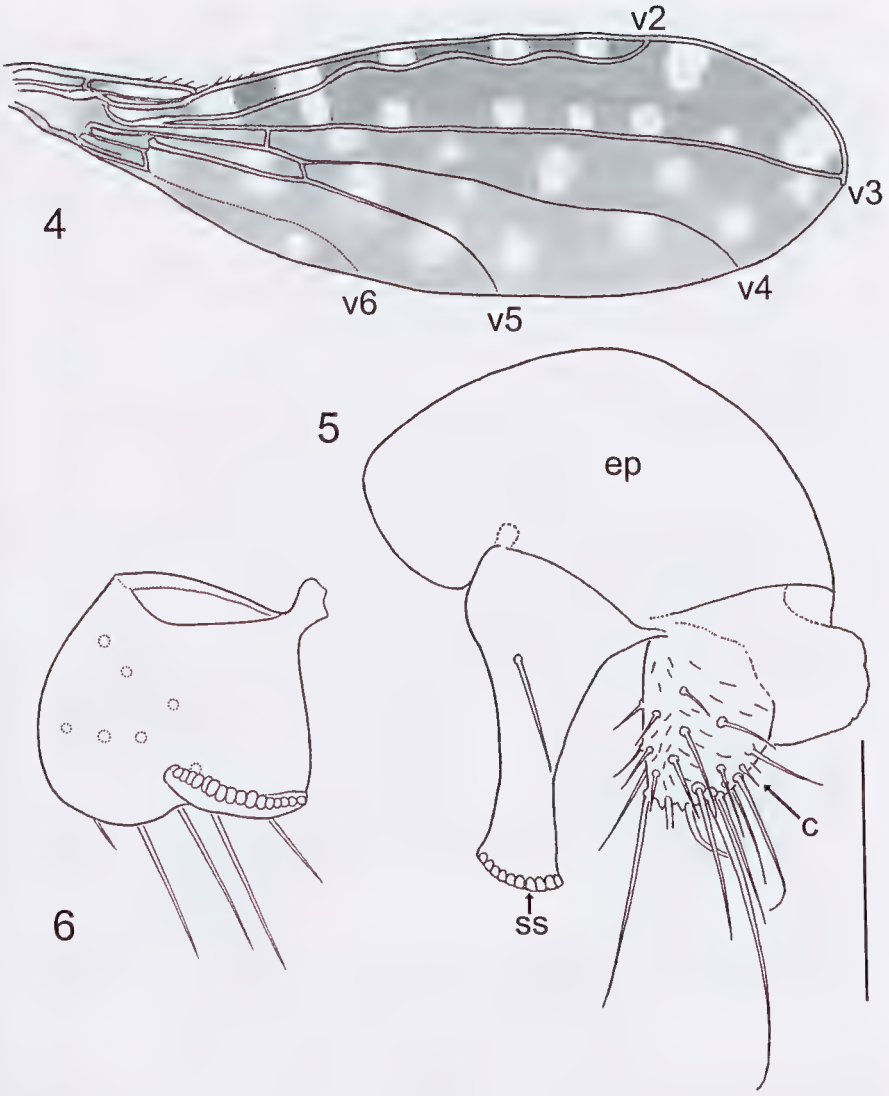
Distribution. Mainly higher rainfall areas from Eungella (Dalrymple Heights) district, Queensland, to eastern Victoria and western Tasmania. See McAlpine and de Keyzer for details.

Teratomyza smithersi sp. n.

(Figs 1, 3–5)

Types. Holotype ♂, QUEENSLAND: Crawford's Lookout, Palmerston Highway, 17.61°S 145.79°E, 8.viii.2010, S.F. McEvey, J. Weiner (AM, K300569, S.McE 28392). *Paratypes.* QUEENSLAND: 2 ♂, 1 ♀, Crawford's Lookout, Palmerston Highway (AM); 1 ♂, Mossman Gorge, April 1967, D.H. Colless (ANIC); 1 ♀, 5-8 km on Mount Lewis Road off Mossman-Mount Molloy Road, April 1967, D.H. Colless (ANIC); 2 ♀, 3 km NNE of Julatten, Sept. 1980, D.H. Colless (ANIC); 1 ♀, Kuranda Range State Forest, Black Mountain Road, April 1967, D.H. Colless (ANIC); 1 ♀, Kuranda, May 1958, D.K. McAlpine (AM); 1 ♂, Barron Falls, near Kuranda, May 1958, D.K. McAlpine (AM); 4 ♂, 2 ♀, Mount Edith, 4-7 miles (*c.* 6-11 km) off Danbulla Road, April 1967, D.H. Colless (ANIC); 6 ♂, 4 ♀, Mount Edith Forest road, 1-1.5 miles off Danbulla Road, May 1967, D.H. Colless (ANIC); 1 ♀, Wongabel State Forest, near Atherton, May 1967, D.H. Colless (ANIC); 2 ♂, 3 ♀, The Boulders, near Babinda, May 1967, July 1971, D.H. Colless, Z.R. Liepa (ANIC); 15 ♂, 18 ♀, The Crater [Ringrose National Park or Mount Hypipamee], Jan, May, Dec. 1961-1972, D.H. Colless, G.A. Holloway, D.K. McAlpine (AM, ANIC, QM); 1 ♀, Palmerston National Park, 23 km NE of Ravenshoe, Nov. 1981, D.H. Colless (ANIC); 1 ♂, summit, Walter Hill Range, Cardstone-Ravenshoe Road, Jan. 1967, D.K. McAlpine, G.A. Holloway (AM); 1 ♂, upper Tully River valley, 17.77°S 145.65°E, Aug. 2010, S.F. McEvey (AM); 1 ♂, Kirrama rain forest [Kirrama Range vicinity between Tully and Herbert Rivers], Aug. 1976, I.R. Bock, P.A. Parsons (ANIC).

Other material. QUEENSLAND: Paluma vicinity, including Birthday Creek (AM, ANIC).



Figs 4-6. *Teratomyza* spp.: (4) *T. smithersi* sp. n., wing; (5) *T. smithersi*, left lateral view of epandrium and associated structures, setulae on epandrium omitted; (6) *T. undulata*, right surstylus, medial view. Scale for Fig. 5 = 0.1 mm. c = cercus, ep = epandrium, ss = surstylus, v2-v6 = veins 2-6.

Description (male, female). A small slender fly, generally resembling the well known *T. undulata* (see McAlpine and de Keyzer 1994 for detail).

Coloration. Head pale tawny-yellow to creamy; postfrons with three broad dark brown to blackish longitudinal stripes on its full length, with whitish

intermediate zones and lateral margins; face, cheeks, and occiput without darker markings. Antenna grey-brown. Thorax pale tawny, with paler mostly creamy pleura, often slightly darker towards upper margin or with distinct brown upper marginal stripe; scutellum usually yellow at extreme apex. Wing membrane grey-brown, darker anteriorly, with numerous white spots, fewer than in *T. undulata*; marginal cell with five large white spots between costa and vein 2, and a smaller pale zone in extreme base; submarginal cell usually with eight or nine white spots. Halter tawny-yellow to grey-brown. Legs yellowish; femora sometimes slightly darker apically. Abdominal tergites tawny-brown, in male usually without markings except for yellow lateral zones on tergite 6, in female often with yellow lateral zones on most tergites.

Head and thorax structurally similar to those of *T. undulata*. Wing: vein 2 with three distinct undulations on which it is thickened and approximated to costa; vein 6 with single undulation or region of curvature; anterior and discal crossveins separated by at least twice length of discal crossvein.

Male postabdomen. Surstylus rather broad basally, much narrowed beyond base, so that spinulose distal margin is much shorter than basal margin articulating with hypandrium; pregonite broadly ovate, larger than surstylus; cercus rather large and stout, with long and short setulae.

Dimensions. Total length, ♂ 1.7-1.9 mm, ♀ 1.9-2.2 mm; length of thorax, ♂ 0.74-0.78 mm, ♀ 0.93-1.00 mm; length of wing, ♂ 2.2-2.4 mm, ♀ 2.8-2.9 mm.

Etymology. The name refers to my late friend Courtenay N. Smithers, formerly of the Australian Museum.

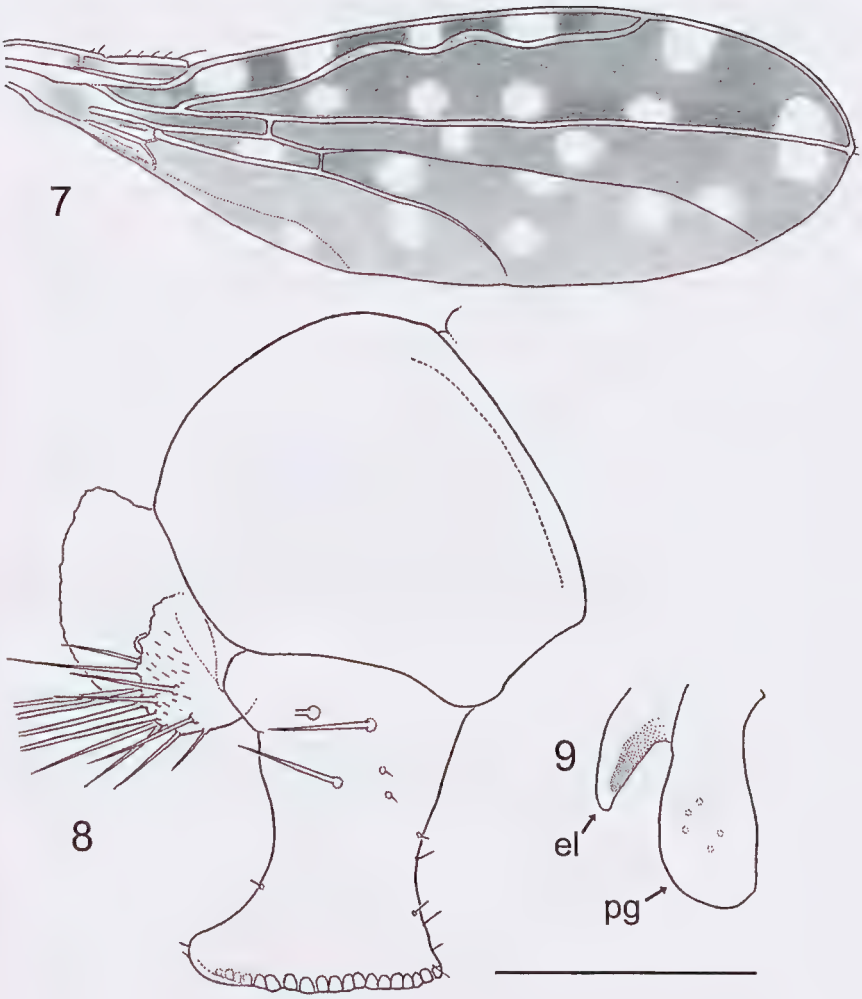
Distribution. Tropical coast of Queensland between 16°S and 19°30'S. It is thus apparently geographically isolated from populations of *T. undulata* but sympatric with *T. pappi*.

Notes. *Teratomyza smithersi* resembles *T. undulata* but differs in characters of wing venation, as indicated in the above key, and in the shape of the surstylus and pregonite. For comparison with *T. pappi* see under that species.

Teratomyza pappi sp. n.

(Figs 7–9)

Types. *Holotype* ♂, QUEENSLAND: Ringrose National Park [The Crater or Mount Hypipamee], 5.v.1967, D.H. Colless (ANIC). *Paratypes*. QUEENSLAND: 1 ♂, same data as holotype (AM); 1 ♂, 5-8 km up Mount Lewis Road, from Mossman-Mount Molloy Road, April 1967, D.H. Colless (ANIC); 3 ♂, Mount Edith, 4-7 km off Danbulla Road, Atherton district, April 1967, D.H. Colless (ANIC).



Figs 7-9. *Teratomyza pappi* sp. n.: (7) wing; (8) right lateral view of epandrium and associated structures, setulae on epandrium omitted; (9) right pregonite and epiphallus. Scale for Figs 8 and 9 = 0.1 mm. el = epiphallus, pg = pregonite.

Description (male only known). A small fly closely resembling *T. undulata* and *T. smithersi*, agreeing with description of the latter, except as indicated below.

Coloration. Head and thorax as in *T. smithersi*; thoracic pleura with definite brown upper marginal stripe. Wing pattern resembling that of *T. smithersi*; usually only four white spots between costa and vein 2 (one specimen showing a smaller distal additional white spot); submarginal cell with six

white spots; only one pale spot between vein 6 and wing margin. Halter with dark grey capitellum (mature specimens).

Head and thorax structurally similar to those of *T. undulata* and *T. smithersi*. Wing: vein 2 with two marked undulations, thickened along their summits, and at most a trace of more distal undulation.

Male postabdomen. Surstylus narrowed towards mid-length, but expanded distally so that distal margin is as long as basal articulating margin and posterodistal angle is subacute; pregonite much shorter than surstylus, slightly narrowed basally, broadly rounded distally; cercus much smaller than in *T. smithersi*.

Dimensions. Total length, 1.8-1.9 mm; length of thorax, 0.75-0.80 mm; length of wing, 2.2-2.3 mm.

Etymology. The name refers to László Papp, who has made the major contribution to knowledge of Oriental Teratomyzidae.

Distribution. Northern Queensland—Atherton to Mossman districts. The distribution is included within that of *T. smithersi*.

Notes. *Teratomyza pappi* is very similar to *T. smithersi* but is distinguished by the contour of vein 2, the distribution of pale wing spots and, in the male, by details of the surstylus, pregonite and cercus.

Acknowledgements

Donald Colless, John Ismay, Shane McEvey, Richard Vockeroth and Jean Weiner supplied significant material. Helen Smith reviewed the manuscript and aided in its preparation. Scott Ginn provided the colour photograph.

References

MALLOCH, J.R. 1933. A remarkable anthomyzid from New Zealand (Diptera). *Stylops* **2**: 113-114.

McALPINE, D.K. 2007. The surge flies (Diptera: Canacidae: Zaleinae) of Australasia and notes on tethinid-canacid morphology and relationships. *Records of the Australian Museum* **59**: 27-64.

McALPINE, D.K. and DE KEYZER, R.G. 1994. Generic classification of the fern flies (Diptera: Teratomyzidae) with a larval description. *Systematic Entomology* **19**: 305-326.

PAPP, L. 2011. Oriental Teratomyzidae (Diptera: Schizophora). *Zootaxa* **2916**: 1-34.